



CELESTRON



Addendum For NexStar GT Hand Control Section Of The Owner's Manual.

The following is an addendum to the NexStar GT section of the owner's manual that explains the current operation and added features to your NexStar hand control. Please refer to these pages for specific information regarding telescope alignment and hand control functions.

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The Hand Control

The NexStar GT's hand controller is designed to give you instant access to all the functions the NexStar has to offer. With automatic slewing to over 4,000 objects, and common sense menu descriptions, even a beginner can master its variety of features in just a few observing sessions. Below is a brief description of the individual components of the NexStar GT hand controller:

1. **Liquid Crystal Display (LCD) Window:** Has a dual-line, 16 character display screen that is backlit for comfortable viewing of telescope information and scrolling text.
2. **Align:** Instructs the NexStar to use a selected star or object as an alignment position.
3. **Direction Keys:** Allows complete control of the NexStar in any direction. Use the direction keys to center objects in the StarPointer finderscope and eyepiece.

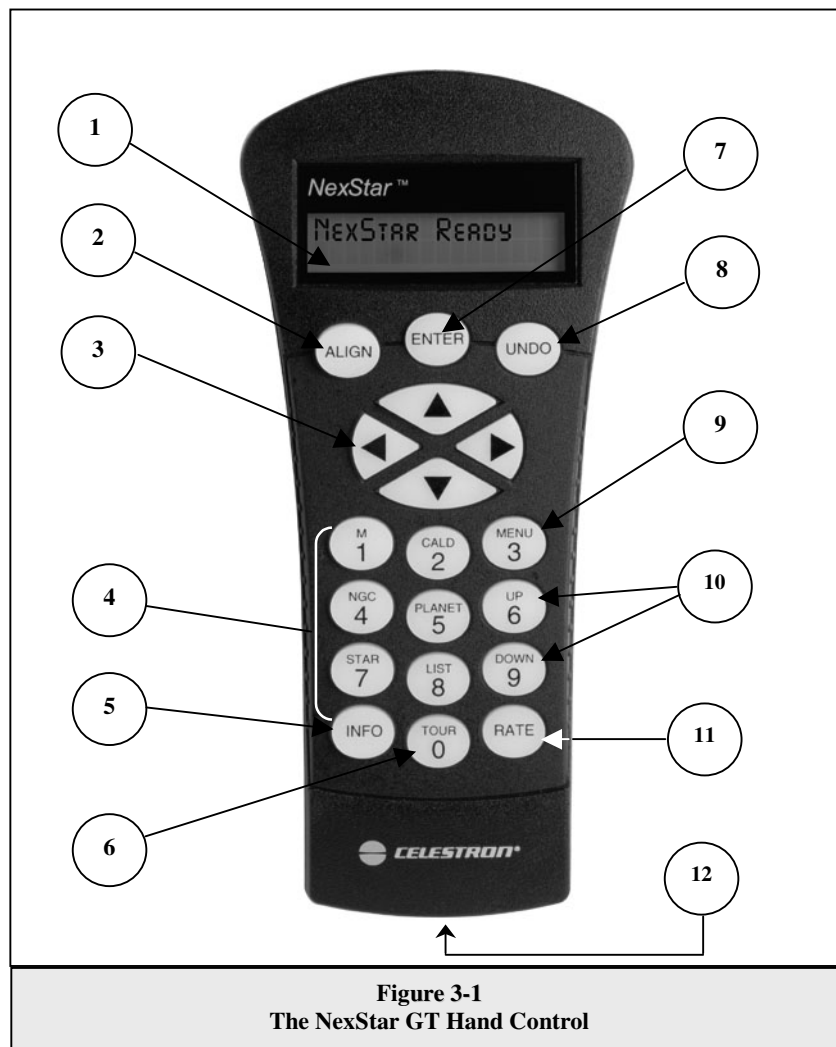


Figure 3-1
The NexStar GT Hand Control

4. **Catalog Keys:** The NexStar has a key on the hand control to allow direct access to each of the catalogs in its 4,000+ object database. The NexStar contains the following catalogs in its database:
 - Messier* – Complete list of all Messier objects.
 - NGC* – Many of the brightest deep sky objects from the Revised New General Catalog.
 - Caldwell* – A combination of the best NGC and IC objects.
 - Planets* - All 8 planets in our Solar System plus the Moon.
 - Stars* – A compiled list of the brightest stars from the SAO catalog.
 - List* – For quick access, all of the best and most popular objects in the NexStar database have been broken down into lists based on their type and/or common name:

Named Stars	Common name listing of the brightest stars in the sky.
Named Objects	Alphabetical listing of over 50 of the most popular deep sky objects.
Double Stars	Alphabetical listing of the most visually stunning double, triple and quadruple stars in the sky.
Variable Stars	Select list of the brightest variable stars with the shortest period of changing magnitude.
Asterisms	A unique list of some of the most recognizable star patterns in the sky.

5. **Info:** Displays coordinates and useful information about objects selected from the NexStar database.
6. **Tour:** Activates the tour mode, which seeks out all the best objects for a given month and automatically slews the NexStar to those objects.
7. **Enter:** Pressing *Enter* allows you to select any of the NexStar functions, accept entered parameters and slew the telescope to displayed objects.
8. **Undo:** *Undo* will take you out of the current menu and display the previous level of the menu path. Press *Undo* repeatedly to get back to a main menu or use it to erase data entered by mistake.
9. **Menu:** Displays the many setup and utilities functions such as tracking rate and user defined objects and many others.
10. **Scroll Keys:** Used to scroll up and down within any of the menu lists. A double arrow symbol on the right side of the LCD indicates that the scroll keys can be used to view additional information.
11. **Rate:** Instantly changes the rate of speed of the motors when the direction buttons are pressed.
12. **RS-232 Jack:** Allows use with a computer and software programs for point and click slewing capability.

Hand Control Operation

This section describes the basic hand control procedures needed to operate the NexStar. These procedures are grouped into three categories: Alignment, Setup and Utilities. The alignment section deals with the initial telescope alignment as well as finding objects in the sky; the setup section discusses changing parameters such as tracking mode and tracking rate; finally, the last section reviews all of the utility functions such as adjusting the telescopes slew limits and backlash compensation.

Alignment Procedure

In order for the NexStar to accurately point to objects in the sky, it must first be aligned with two known positions (stars) in the sky. With this information, the telescope can create a model of the sky, which it uses to locate any object with known coordinates.

Auto-Align

Auto-Align is the easiest way to get your NexStar aligned and ready to observe. Even if you do not know a single star in the sky, the NexStar will align itself by guiding the user through the alignment procedure by asking for basic information like the date, time and location. The NexStar will then automatically choose two stars for alignment and roughly center the stars in the field of view of the Star Pointer. Before the telescope is ready to be aligned, it should be set up in an outside location with all accessories (eyepiece, diagonal and Star Pointer) attached and lens cover removed as described in the *Assembly* section of the manual.

1. Once the NexStar is powered on the display will read *NexStar Ready*. Press ENTER to begin alignment.

The first time that the NexStar is used, it will request information to help identify the model of telescope. Once powered on, the hand control will display the message **Select Model**. Use the Up and Down menu keys (10) to scroll through the different NexStar models. Press ENTER when your NexStar model is displayed on the hand control. This information will be retained for future use and will not be displayed again. If for some reason the incorrect model was selected or you wish to use your hand control on a different NexStar model, the *Select Model* utility feature allows you to re-select the proper NexStar model from the displayed list (see *Select Model* later in this section).

2. Use the Up and Down scroll keys to select *AutoAlign* if it is not already displayed, and press ENTER.
3. The telescope will then ask you to use the direction keys (3) to level the telescope tube and point the front of the telescope towards north. North can be found by finding the direction of the North Star (Polaris) or by using a compass. You do not need to point at the North Star, only the north horizon. Alignment only needs to be approximate, however a close alignment will make the auto alignment more accurate. Once the telescope is in the north and level position, press ENTER.
4. The hand control display will then ask for the following information:

Location - The NexStar will display a list of cities to choose from. Choose the city from the database that is closest to your current observing site. The city you choose will be remembered in the hand controls memory so that it will be automatically displayed the next time an alignment is done. Alternatively, if you know the exact longitude and latitude of your observing site, it can be entered directly into the hand control and remembered for future use as well. To choose a location city:

- Use the Up and Down scroll keys to choose between *City Database* and *Custom Site*. *City Database* will allow you to select the closest city to your observing site from a list of either international or U.S. location. *Custom Site* allows you to enter the exact longitude and latitude of your observing site. Select *City Database* and press ENTER.
- The hand control will allow you to choose from either U.S. or international locations. For a listing of U.S. locations by state and then by city, press ENTER while **United States** is displayed. For international locations, use the Up or Down scroll key to select **International** and press ENTER.
- To display a list of local cities, first select your state from the alphabetical listing (or a list of countries if International locations was selected) and press ENTER.
- Choose the closest city to your location from the displayed list and press ENTER.

Time - Enter the current time for your area. You can enter either the local time (i.e. 8:00), or you can enter military time (i.e. 20:00).

- Select PM or AM. If military time was entered, the hand control will bypass this step.
- Choose between Standard time or Daylight Savings time. Use the Up and Down scroll buttons (10) to toggle between options.
- Select the time zone that you are observing from. Again, use the Up and Down buttons (10) to scroll through the choices. For time zone information, refer to the Time Zone map in the appendix of this manual.

Date - Enter the month, day and year of your observing session. The display will read: mm/dd/yy.

- *If the wrong information has been input into the hand control, the UNDO button will act as a backspace allowing the user to re-enter information.*
- *The next time that your NexStar is Auto Aligned, the hand control will automatically display the last location (either a city or longitude/latitude) that was entered. Pressing the UNDO button will allow you to go back and select a new city location or longitude/latitude.*

Based on this information, the NexStar will automatically select a bright star that is above the horizon and slew towards it. At this point the telescope is only roughly aligned, so the alignment star should only be close to the field of view of



the Star Pointer finder. Once finished slewing, the display will ask you to use the arrow buttons to align the selected star with the red dot in the center of the Star Pointer. If for some reason the chosen star is not visible (perhaps behind a tree or building) you can press UNDO to select and slew to a different star. Once centered in the finder, press ENTER. The display will then instruct you to center the star in the field of view of the eyepiece. When the star is centered, press ALIGN to accept this star as your first alignment star. (There is no need to adjust the slewing rate of the motors after each alignment step. The NexStar automatically selects the best slewing rate for aligning objects in both the Star Pointer and the eyepiece). After the first alignment star has been entered the NexStar will automatically slew to a second alignment star and have you repeat the same procedure for that star. When the telescope has been aligned to both stars the display will read **Alignment Successful**, and you are now ready to find your first object.

**Observing
Tips**

If the wrong star was centered and aligned to, the NexStar display will read **Align Failed**. Press UNDO to begin the alignment procedure again.

✦ *If you are not sure if the correct star was centered, always remember that the alignment star will be the brightest star nearest the field of view of the finder. There may be other fainter stars visible that are closer to the center of the Star Pointer, but the actual alignment star will be obviously brighter than any other star in the area.*

✦ *For the best possible pointing accuracy, always center the alignment stars using the up arrow button and the right arrow button. Approaching the star from this direction when looking through the eyepiece will eliminate much of the backlash between the gears and assure the most accurate alignment possible.*

Two Star Alignment

With the two-star alignment method, the NexStar requires the user to know the positions of only two bright stars in order to accurately align the telescope with the sky and begin finding objects. Here is an overview of the two-star alignment procedure:

1. Once the NexStar is powered on, use the Up and Down scroll keys to select **Two-Star Align**, and press ENTER.
2. The NexStar display will ask you to move the telescope tube until it is horizontal to the ground. To do this, use the direction keys (3) to move the telescope until it is roughly level with the ground. Press ENTER.
3. The **SELECT STAR 1** message will appear in the top row of the display. Use the Up and Down scroll keys (10) to select the star you wish to use for the first alignment star. Press ENTER.
4. NexStar then asks you to center in the eyepiece the alignment star you selected. Use the direction buttons to slew the telescope to the alignment star and carefully center the star in the eyepiece.
5. Once the alignment star is centered in the field of view of the eyepiece, press the ALIGN key (2) to accept this position.
6. NexStar will then ask you to select and center a second alignment star and press the ALIGN key. It is best to choose alignment stars that are a good distance away from one another. Stars that are at least 40° to 60° apart from each other will give you a more accurate alignment than stars that are close to each other.

Once the second star alignment is completed properly, the display will read **Alignment Successful**, and you will hear the tracking motors turn-on and begin to track.

Quick-Align

Quick-Align allows you to input all the same information as you would for the AutoAlign procedure. However, instead of slewing to two alignment stars for centering and alignment, the NexStar bypasses this step and simply models the sky based on the information given. This will allow you to roughly slew to the coordinates of bright objects like the moon and planets and gives the NexStar the information needed to track objects in altazimuth in any part of the sky. Quick-Align is not meant to be used to accurately locate small or faint deep-sky objects or to track objects accurately for photography. *Note: Once a Quick-Align has been done, you can use the Re-alignment feature (see below) to improve your telescopes pointing and tracking accuracy.*

To use Quick-Align:

1. Select *Quick-Align* from the alignment options.
2. Use the arrow buttons to level the tube and position the telescope tube towards north and press ENTER.

3. The hand control will then ask you to input all the same time and location information as you would for the AutoAlign procedure.
Once entered, the NexStar will model the sky based on this information and display **Alignment Successful**.

NexStar Re-Alignment

The NexStar has a re-alignment feature which allows you to replace either of the two original alignment stars with a new star or celestial object. This can be useful in several situations:

- If you are observing over a period of a few hours, you may notice that your original two alignment stars have drifted towards the west considerably. (Remember that the stars are moving at a rate of 15° every hour). Aligning on a new star that is in the eastern part of the sky will improve your pointing accuracy, especially on objects in that part of the sky.
- If you have aligned your telescope using the Quick-Align method, you can use *re-align* to align to two actual objects in the sky. This will improve the pointing accuracy of your telescope without having to re-enter addition information.

To replace an existing alignment star with a new alignment star:

1. Select the desired star (or object) from the database and slew to it.
2. Carefully center the object in the eyepiece.
3. Once centered, press the UNDO button until you are at the main menu.
4. With **NexStar Ready** displayed, press the ALIGN key on the hand control.
5. The display will then ask you which alignment star you want to replace.
6. Use the UP and Down scroll keys to select the alignment star to be replaced, and press ENTER. It is usually best to replace the star closest to the new object. This will space out your alignment stars across the sky.
7. Press ALIGN to make the change.

Object Catalog

Selecting an Object

Now that the telescope is properly aligned, you can choose an object from any of the catalogs in the NexStar's database. The hand control has a key designated for each of the catalogs in its database. There are two ways to select objects from the database; scrolling through the named object lists and entering object numbers:

- Pressing the LIST key on the hand control will access all objects in the database that have common names or types. Each list is broken down into the following categories: Named Stars, Named Object, Double Stars, Variable Stars and Asterisms. Selecting any one of these options will display an alpha-numeric listing of the objects under that list. Pressing the Up and Down keys (10) allows you to scroll through the catalog to the desired object.
- Pressing any of the catalog keys (M, CALD, NGC, or STAR) will display a blinking cursor below the name of the catalog chosen. Use the numeric key pad to enter the number of any object within these standardized catalogs. For example, to find the Orion Nebula, press the "M" key and enter "042".
- Pressing the PLANET button will allow you to use the UP and DOWN arrow keys to scroll through and select the eight planets as well as the moon.

To download a list of all the stars contained in the STAR Catalog with SAO number cross references, logon to our web site at www.celestron.com.

Slewing to an Object

Once the desired object is displayed on the hand control screen, you have two options:

- **Press the INFO Key.** This will give you useful information about the selected object such as magnitude, constellation and fascinating facts about many of the objects.

The speed at which information scrolls across the hand control display can be changed while the information is being viewed:

- Press the “1” key repeatedly to speed up the scroll speed.
Press the “4” key repeatedly to slow down the scroll speed.
Press the “7” key to freeze and unfreeze the information on the display.
- **Press the ENTER Key.** This will automatically slew the telescope to the coordinates of the object. While the telescope is slewing to the object, the user can still access many of the hand control functions (such as displaying information about the object).

If you slew to an object that is below the horizon, NexStar will notify you by displaying a message reminding you that you have selected an object outside of your slew limits (see Slew Limits in the Utility Features section of the manual). Press UNDO to go back and select a new object. Press ENTER to ignore the message and continue the slew. The NexStar hand control will only display objects that are below the horizon if the Filter Limits are set below 0° in altitude. See Filter Limits in the Utility Feature section of the manual for more information on setting the filter limits.

Caution: Never slew the telescope when someone is looking into the eyepiece. The telescope can move at fast slew speeds and may hit an observer in the eye.

Object information can be obtained without having to do a star alignment. After the telescope is powered on, pressing any of the catalog keys allows you to scroll through object lists or enter catalog numbers and view the information about the object as described above.

Tour Mode

The NexStar includes a tour feature which automatically allows the user to choose from a list of interesting objects based on the date and time in which you are observing. The automatic tour will display only those objects that are within your set filter limits. To activate the Tour mode, press the TOUR key (6) on the hand control. The NexStar will display the best objects to observe that are currently in the sky.

- To see information and data about the displayed object, press the INFO key.
- To slew to the object displayed, press ENTER.
- To see the next tour object, press the Down key.

Direction Buttons

The NexStar has four direction buttons in the center of the hand control which controls the telescope motion in altitude (up and down) and azimuth (left and right). The telescope can be controlled at nine different speed rates.

$1 = 2x$	$6 = .5^\circ / sec$
$2 = 4x$	$7 = 1^\circ / sec$
$3 = 8x$	$8 = 2^\circ / sec$
$4 = 16x$	$9 = 4^\circ / sec$
$5 = 32x$	
Nine available slew speeds	

Rate Button

Pressing the RATE key (11) allows you to instantly change the speed rate of the motors from high speed slew rate to precise guiding rate or anywhere in between. Each rate corresponds to a number on the hand controller key pad. The number 9 is the fastest rate (approximately 4° per second, depending on power source) and is used for slewing between objects and locating alignment stars. The number 1 on the hand control is the slowest rate (2x sidereal) and can be used for accurate centering of objects in the eyepiece. To change the speed rate of the motors:

- Press the RATE key on the hand control. The LCD will display the current speed rate.
- Press the number on the hand control that corresponds to the desired speed.

The hand control has a "double button" feature that allows you to instantly speed up the motors without having to choose a speed rate. To use this feature, simply press the arrow button that corresponds to the direction that you want to move the telescope. While holding that button down, press the opposite directional button. This will increase the speed to the maximum slew rate.

Set Up Procedures

The NexStar contains many user defined setup functions designed to give the user control over the telescope's many advanced features. All of the set up and utility features can be accessed by pressing the MENU key and scrolling through the options:

Tracking Mode Once the NexStar is aligned the tracking motors will automatically turn on and begin tracking the sky. However, the tracking can be turned off for terrestrial use:

Alt-Az This is the default tracking rate and is used when the telescope has been properly aligned.

EQ North Used to track the sky when the telescope is polar aligned using an equatorial wedge in the Northern Hemisphere.

EQ South Used to track the sky when the telescope is polar aligned using an equatorial wedge in the Southern Hemisphere.

Off When using the telescope for terrestrial (land) observation the tracking can be turned off so that the telescope never moves.

Note: The EQ North and EQ South tracking modes are only needed with telescopes that can be polar aligned, such as the NexStar 4, 5 and 8. The NexStar 60, 80 and 114 are exclusively Alt-Az mounted telescopes and do not require equatorial tracking.

Tracking Rate - In addition to being able to move the telescope with the hand control buttons, the NexStar will continually track a celestial object as it moves across the night sky. The tracking rate can be changed depending on what type of object is being observed:

Sidereal This rate compensates for the rotation of the earth by moving the telescope at the same rate as the rotation of the earth, but in the opposite direction. When tracking in Alt-Az mode, the telescope must make corrections in both altitude and azimuth.

Lunar Used for tracking the moon when observing the lunar landscape.

Solar Used for tracking the Sun when solar observing using a proper solar filter.

View Time-Site - *View Time-Site* will display the last saved time and longitude/latitude entered in the hand control.

Sidereal Time – Displays the Sidereal time for your current time and location. This is useful for knowing the right ascension of celestial objects that are located on the local meridian at that time.

Filter Limits – When an alignment is complete, the NexStar automatically knows which celestial objects are above the horizon. As a result, when scrolling through the database lists (or selecting the Tour function), the NexStar hand control will display only those objects that are known to be above the horizon when you are observing. You can customize the object database by selecting altitude limits that are appropriate for your location and situation. For example, if you are observing from a mountainous location where the horizon is partially obscured, you can set your minimum altitude limit to read +20°. This will make sure that the hand control only displays objects that are higher in altitude than 20°.

**Observing
Tip!**

If you want to explore the entire object database, set the maximum altitude limit to +90° and the minimum limit to -90°. This will display every object in the database lists regardless of whether it is visible in the sky from your location.

RS-232 - The NexStar has a RS-232 port located on the bottom of the hand control that allows it to communicate with many astronomy computer programs such as certain versions of *The Sky* by Software Bisque. Before attempting to create a link with a computer, select the RS-232 option and press Enter.

User Defined Objects - The NexStar can store up to 50 different user defined objects in its memory. The objects can be daytime land objects or an interesting celestial object that you discover that is not included in the regular database. There are several ways to save an object to memory depending on what type of object it is:

Save Sky Object: The NexStar stores celestial objects to its database by saving its right ascension and declination in the sky. This way the same object can be found each time the telescope is aligned. Once a desired object is centered in the eyepiece, simply scroll to the "**Save Sky Obj**" command and press ENTER. The display will ask you to enter a number between 1-25 to identify the object. Press ENTER again to save this object to the database.

Save Land Object: The NexStar can also be used as a spotting scope on terrestrial objects. Fixed land objects can be stored by saving their altitude and azimuth relative to the location of the telescope at the time of observing. Since these objects are relative to the location of the telescope, they are only valid for that exact location. To save land objects, once again center the desired object in the eyepiece. Scroll down to the "**Save Land Obj**" command and press ENTER. The display will ask you to enter a number between 1-25 to identify the object. Press ENTER again to save this object to the database.

Enter R.A. - Dec: You can also store a specific set of coordinates for an object just by entering the R.A. and declination for that object. Scroll to the "**Enter RA-DEC**" command and press ENTER. The display will then ask you to enter first the R.A. and then the declination of the desired object.

GoTo Object: To go to any of the user defined objects stored in the database, scroll down to either **GoTo Sky Obj** or **GoTo Land Obj** and enter the number of the object you wish to select and press ENTER. NexStar will automatically retrieve and display the coordinates before slewing to the object.

To replace the contents of any of the user defined objects, simply save a new object using one of the existing identification numbers; NexStar will replace the previous user defined object with the current one.

Get RA-DEC - Displays the right ascension and declination for the current position of the telescope.

Get Alt-Az - Displays the relative altitude and azimuth for the current position of the telescope.

Goto R.A-Dec - Allows you to input a specific R.A. and declination and slew to it.

Goto Alt-Az - Allows you to enter a specific altitude and azimuth position and slew to it.



To store a set of coordinates (R.A./Dec) permanently into the NexStar database, save it as a *User Defined Object* as described above.

Utility Features

Scrolling through the MENU options will also provide access to several advanced utility functions such as anti-backlash compensation and slew limits.

Setup Time-Site - Allows the user to customize the NexStar display by changing time and location parameters (such as time zone and daylight savings).

Anti-backlash - All mechanical gears have a certain amount of backlash or play between the gears. This play is evident by how long it takes for a star to move in the eyepiece when the hand control arrow buttons are pressed (especially when changing directions). The NexStar's anti-backlash features allows the user to compensate for backlash by inputting a value which quickly rewinds the motors just enough to eliminate the play between gears. The amount of compensation needed depends on the slewing rate selected; the slower the slewing rate the longer it will take for the star to appear to move in the eyepiece. Therefore, the anti-backlash compensation will have to be set higher. You will need to experiment with different values; a value between 20 and 50 is usually best for most visual observing, whereas a higher value may be necessary for photographic guiding.

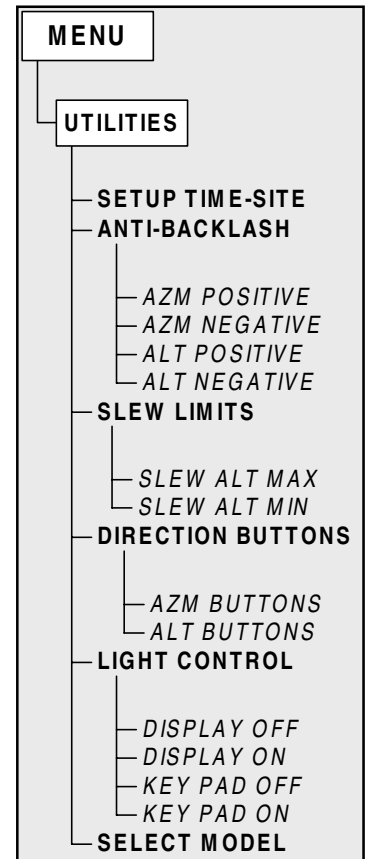
To set the anti-backlash value, scroll down to the anti-backlash option and press ENTER. Enter a value from 0-100 for both azimuth and altitude directions and press ENTER after each one to save these values. NexStar will remember these values and use them each time it is turned on until they are changed.

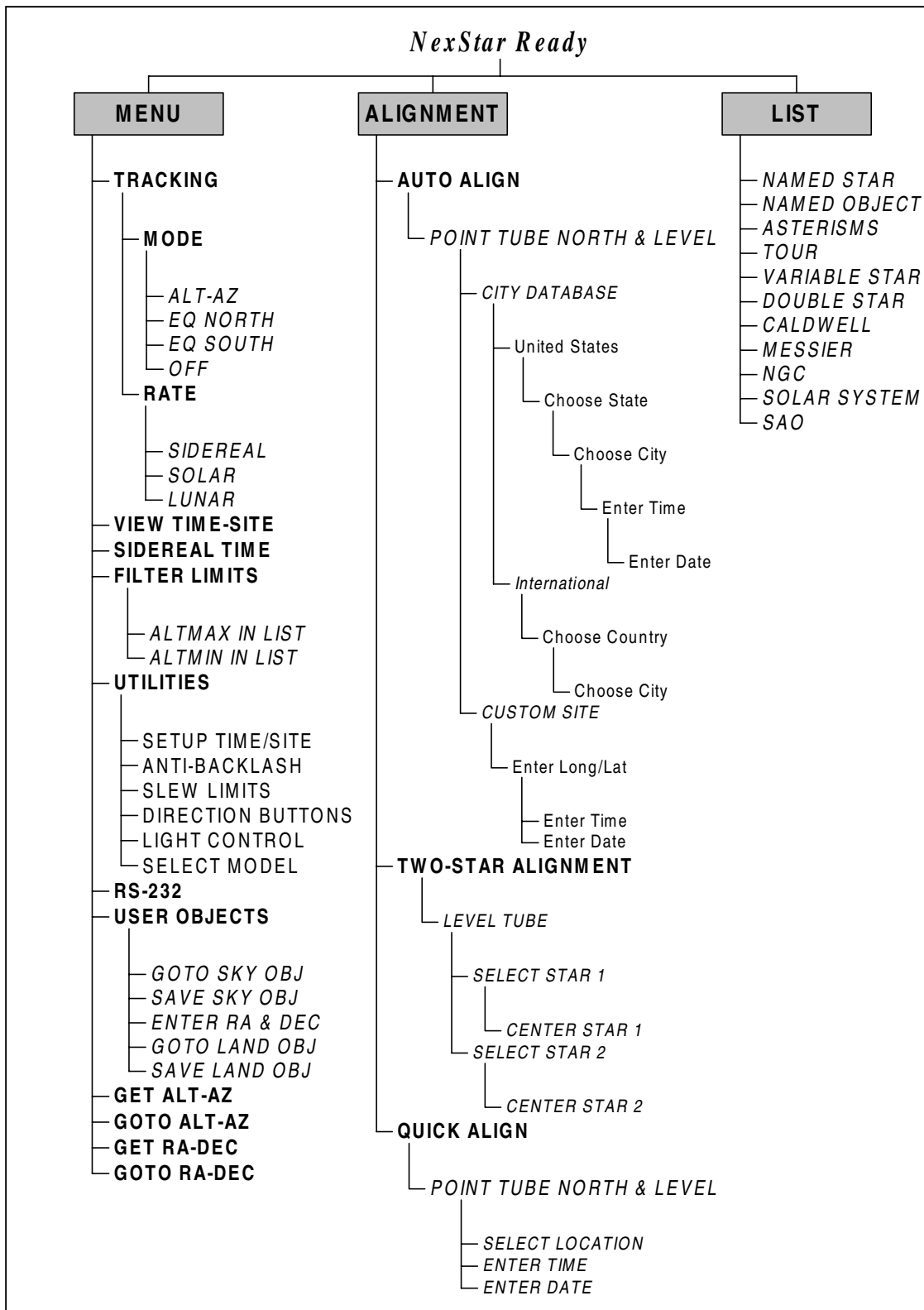
Slew Limits - Sets the limits in altitude that the telescope can slew without displaying a warning message. The slew limits prevent the telescope tube from slewing to an object below the horizon or slewing to an object that is high enough that the tube might hit one of the tripod legs. However, the slew limits can be customized depending on your needs. For example, if you would like to slew to an object that is close to the zenith and are certain that the tube will not hit the tripod legs, you can set the slew limits to 90° in altitude. This will allow the telescope to slew to any object above the horizon without warning.

Direction Buttons - The direction a star moves in the eyepiece varies depending on the accessories being used. This can create confusion when guiding on a star using an off-axis guider versus a straight through guide scope. To compensate for this, the direction of the drive control keys can be changed. To reverse the button logic of the hand control, press the MENU button and select *Direction Buttons* from the Utilities menu. Use the Up/Down arrow keys (10) to select either the Azimuth buttons (left and right) or Altitude buttons (up and down) and press ENTER. Pressing ENTER again will reverse the direction of the hand control buttons from their current state. Direction Buttons will only change the eyepiece rates (rate 1-6) and will not affect the slew rates (rate 7-9).

Light Control - This feature allows you to turn off both the red key pad light and LCD display for daytime use to conserve power and to help preserve your night vision.

Select Model - The first time the NexStar is powered on, the hand control display allows you to select your NexStar from a list of different models. If for some reason the incorrect model was selected or you wish to use your hand control on a different NexStar model, the *Select Model* utility feature allows you to re-select the proper NexStar model from the displayed list. Once the correct NexStar model has been selected the power needs to be restarted before beginning the alignment procedure. The *Select Model* feature will return the hand control to its original factory settings. Parameters such as backlash compensation values along with slew and filter limits will be reset. However, stored parameters such as user defined objects will remain saved even after the model has been changed.





NexStar Menu Tree:
 The following figure is a menu tree showing the sub-menus associated with the primary command functions

APPENDIX C – MAPS OF TIME ZONES

